WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

and

FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
Collaborating with
CALIFORNIA DEPARTMENT of WATER RESOURCES
and
BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES

AS OF
APR. 1, 1969

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts and appears as streamflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season will interact with a resultant average effect on runoff. Early season forecasts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth and water equivalent at surveyed and marked locations in mountain areas. A total of about ten samples are taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1400 snow courses in Western United States and in the Columbia Basin in British Columbia. In the near future, it is anticipated that automatic snow water equivalent sensing devices along with radio telemetry will provide a continuous record of snow water equivalent at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and local reports. Other data on reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulation to date, and storage in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic data summary and published about October 1 of each year.

PUBLISHED BY SOIL CONSERVATION SERVICE

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 209, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state and local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85205
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80521
Idoho	P. O. Box 38, Boise, Idaho 83707
Montano	P. O. Box 98, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Portland, Oregon 97205
Utoh	4012 Federal Building, Salt Lake City, Utah 84111
Washington	360 U.S. Court House, Spokane, Washington 99201
Wyoming	P. O. Box 340, Casper, Wyoming 82602

PUBLISHED BY OTHER AGENCIES

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, California Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Forests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia

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ISSUED

APRIL 1, 1969

The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Weather Bureau, Geological Survey, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

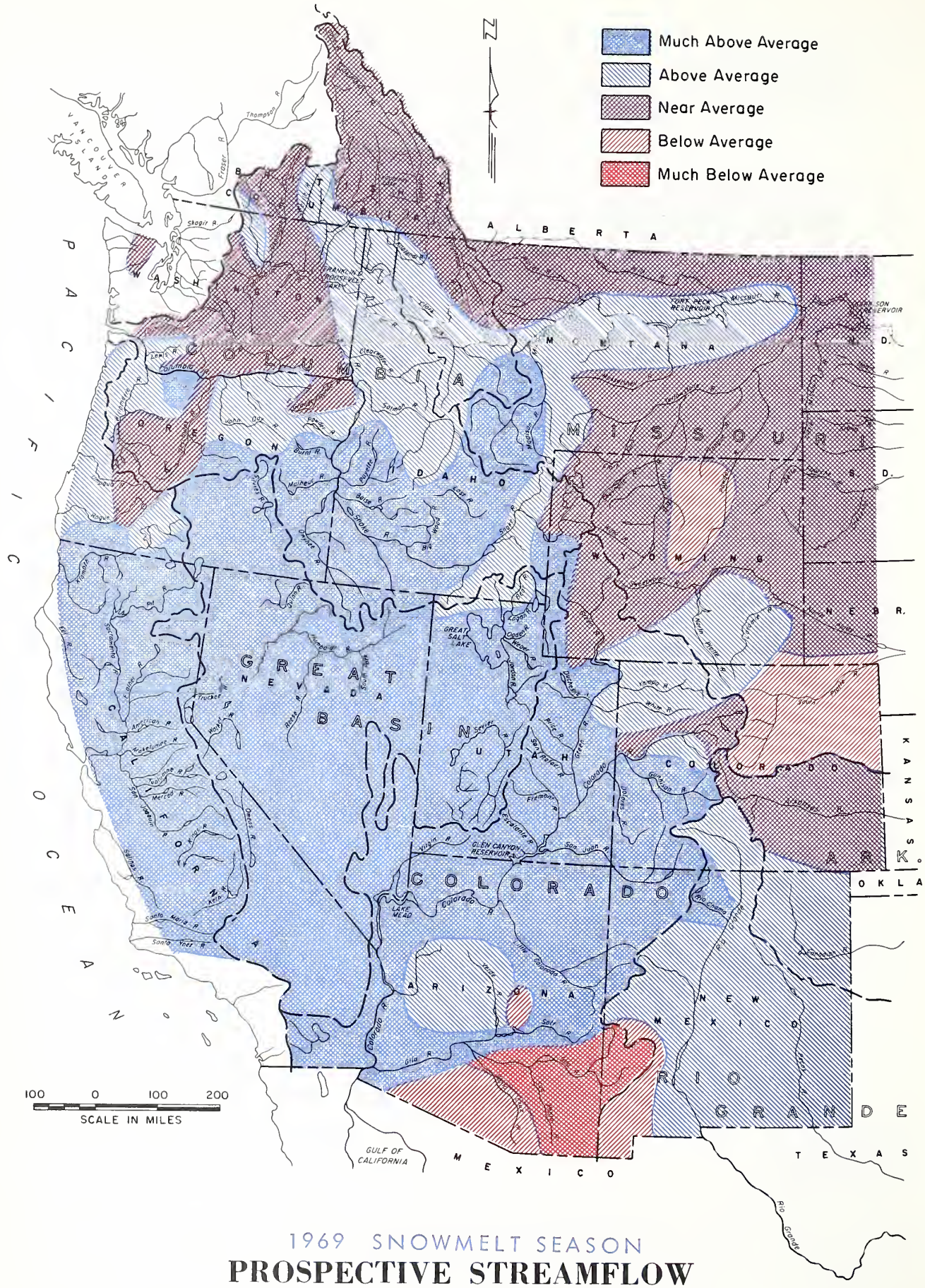
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, from data supplied by Snow Survey Supervisors of the Soil Conservation Service in the States of Alaska, Arizona, Colorado and New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Data from California was supplied by the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources.

Data from British Columbia was supplied by the Chief, Hydrology Division, Water Investigations Branch, Department of Lands, Forests and Water Resources.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENNETH E. GRANT, ADMINISTRATOR



1969 SNOWMELT SEASON

PROSPECTIVE STREAMFLOW

AS OF APRIL 1, 1969

WATER SUPPLY OUTLOOK

1969 SNOWMELT SEASON
AS OF APRIL 1, 1969

GOOD TO EXCELLENT WATER SUPPLY IS ANTICIPATED FOR MOST WESTERN AREAS IN 1969. MINOR DEFICIENCIES ARE EXPECTED IN EASTERN COLORADO AND NORTH CENTRAL WYOMING. EXTRA PUMPING WILL BE REQUIRED ALONG ARIZONA'S GILA RIVER TO OFFSET LOW STREAM SUPPLIES. POTENTIAL HIGH WATER PROBLEMS ARE ANTICIPATED IN AREAS OF CALIFORNIA, NEVADA, UTAH AND SOUTHERN IDAHO.

Except for Arizona's Gila river all watersheds west of the Continental Divide are expected to have average or greater streamflow during 1969, assuring good to excellent supplies of water for irrigation. However, record to near record snowpacks in much of California, Nevada, Utah and parts of southern Idaho are expected to create some high water problems when the snows melt. Streams are expected to flow at near twice to over four times normal amounts. Flow of the Red Rock river in Montana is expected to be highest of the past 30 years. Most reservoirs in these areas are being operated to manage peak flows so that they will produce a minimum of damage.

March weather was mixed in its effect on the water supply for the west, but was generally more beneficial than detrimental. Above normal monthly snowfall improved the water short outlook for Colorado's Purgatoire and Cucharas rivers and for New Mexico's Pecos and Canadian rivers. Dry weather eased high water potentials throughout the Columbia Basin, in California, Nevada and northern Utah. On the detrimental side, dry weather increased the probability of minor water shortages along Colorado's South Platte river while above normal snowfall intensified high water potentials in southern Utah.

The dry March weather combined with cool temperatures aided in dissipating high water potential from valley and low foothill areas in much of Oregon, Washington, Idaho and northern Utah. During late March warm days with cool nights continued removal of these valley snows without creating unusual problems. In southern Utah where nights remained warm, some flooding of farm lands and washing out of roads was reported. The snowpack remains heavy on low elevation mountain watersheds. In Washington and Oregon no major high water problems are anticipated unless rapid snowmelt is triggered by and combined with heavy warm rains.

The California Department of Water Resources reports that despite below normal precipitation during March, April 1 snow surveys show that the snowmelt runoff this year will be one of the greatest of record. These snowpack measurements reveal that almost all previous records have been broken in the higher elevations of the Sierras. Conditions remain critical in the Tulare Lake basin of the lower San Joaquin river as the water agencies in this area prepare for the greatest snowmelt runoff of record.

The snowpack on the upper Columbia and Kootenai rivers in Canada is expected to produce slightly below average flows. Snows increase toward the international boundary. Most streams in Washington will produce average to 15 percent above average flows, while northern Idaho streams should yield 10 percent to 30 percent above normal amounts. Near the Continental Divide in Montana, forecasts in the Columbia Basin range from about 5 to 10 percent more than usual on the Flathead and Kootenai rivers to 20 to 40 percent above average on the Clark Fork. East of the Continental Divide, average to 10 percent less than average flows are forecast for the Milk, Marias and Sun rivers, northern tributaries to the Missouri river. South of here forecasts increase to near 150 percent on the Madison and Jefferson rivers and then fall off on the Yellowstone river to near average or a little above.

In Wyoming near average flows are expected from the Snake above Palisade reservoir, the Shoshone, Wind, Big Horn, Sweetwater and Green rivers. Minor shortages may be experienced along the Little Big Horn and Powder rivers in north central Wyoming while heavier snowpacks on the Salt and Greys rivers indicate streamflows near 30 to 40 percent above average. The North Platte and Laramie rivers, along with Colorado's Yampa and White rivers which all head in the same area, can expect 10 to 20 percent greater than usual streamflow.

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS APRIL 1, 1969

MAJOR BASIN AND SUB — WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
MISSOURI BASIN		
Jefferson	115	130
Madison	133	128
Gallatin	81	101
Missouri Main Stem	89	104
Yellowstone	89	101
Shoshone	129	99
Wind	101	100
North Platte	103	101
South Platte	80	73
ARKANSAS BASIN		
Arkansas	91	98
Canadian	79	133
RIO GRANDE BASIN		
Rio Grande (Colo.)	122	123
Rio Grande abv. Otowi Bridge	143	148
Pecos	60	231
COLORADO BASIN		
Green (Wyo.)	124	102
Yampa - White	102	108
Duchesne	135	145
Price	149	168
Upper Colorado	103	98
Gunnison	120	131
San Juan	125	134
Dolores	126	151
Virgin	202	297
Gila	32	345
Salt	69	213
GREAT BASIN		
Bear	130	126
Logan	121	110
Ogden	160	148
Weber	133	140
Provo - Utah Lake	143	164
Jordan	123	132
Sevier	150	216
Walker - Carson	290	219
Tahoe - Truckee	236	198
Humboldt	584	141
Lake Co. (Oregon)	413	163
Harney Basin (Oregon)	398	145
UPPER COLUMBIA BASIN		
Columbia (Canada)	82	95
Kootenai	114	101
Clark Fork	118	109
Bitterroot	114	101
Flathead	122	101
Spokane	160	113
Okanogan	116	108
Methow	150	131
Chelan	119	112
Wenatchee	266	138

MAJOR BASIN AND SUB — WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
SNAKE BASIN		
Snake above Jackson, Wyo.	115	102
Snake above Hiese, Idaho	115	104
Snake abv. American Falls Res.	124	114
Henry's Fork	160	150
Southern Idaho Tributaries	149	113
Big and Little Wood	236	172
Boise	202	124
Owyhee	844	203
Payette	172	125
Malheur	340	139
Weiser	147	117
Burnt	387	128
Powder	163	114
Salmon	154	126
Grande Ronde	349	118
Clearwater	153	101
LOWER COLUMBIA BASIN		
Yakima	323	132
Umatilla	1131	129
John Day	594	126
Deschutes - Crooked	258	116
Hood	565	146
Willamette	281	123
Lewis	412	129
Cowlitz	229	112
PACIFIC COASTAL BASIN		
Puget Sound	708	124
Olympic Peninsula	149	109
Umpqua - Rogue	271	144
Klamath	293	146
Trinity	220	185
CALIFORNIA CENTRAL VALLEY		
Upper Sacramento	210	170
Feather	210	190
Yuba	210	180
American	265	200
Mokelumne	270	190
Stanislaus	290	205
Tuolumne	275	205
Merced	315	205
San Joaquin	425	235
Kings	440	265
Kaweah	385	270
Tule	735	295
Kern	425	275

Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.

Average is for 1953-67 *period.* California averages are for the period 1931-65.

Based on Selected Snow Courses determined by Distribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.

While some deficiencies are expected along the eastern slope of the Colorado Rockies, no serious water shortages are anticipated. Carryover reservoir storage is good on the South Platte and will tend to offset the below normal runoff. Reservoir storage is poor on the Arkansas river and can result in some shortages, particularly if the spring months are dry.

In New Mexico water supply should be excellent on the Pecos and Canadian rivers, where flows should range from 10 to 30 percent more than average. Heavy snows on the Rio Chama give a forecast of 176 percent inflow to El Vado reservoir, while the Rio Grande at Otowi Bridge is forecast at 148 percent.

Forecasts for the Upper Colorado river basin range from about 5 percent above average on the Colorado river at Dotsero to about 340 percent on the Virgin river in Utah. Total inflow to Lake Powell from the upper basin is forecast at 137 percent for the April-July period.

Arizona's Salt River project is expected to have an excellent water supply, with total spring runoff expected to be 162 percent. Reservoir storage is also well above average.

MISSOURI BASIN

Water supplies during 1969 should be satisfactory or better on the upper Missouri and its tributaries in Montana, assuming average weather conditions exist during spring months. Major reservoirs on the main river in Montana and the Dakotas have above average storage. Snow cover is below average over central Montana and near average or above in the remainder of the state. It is particularly heavy on upper Red Rock and Madison river drainages.

In Wyoming, forecasts of snowmelt season flow are for near average amounts to come from the Shoshone, Wind and Sweetwater rivers. Below average flows are expected from smaller streams coming from both sides of the Big Horn Mountains where some deficiencies may occur, particularly if spring months are dry. The North Platte at Saratoga and Laramie near Jelm are expected to yield 10 to 20 percent above average flows.

March snowfall was considerably below normal on the watersheds of the South Platte river lowering forecasts on it and its tributaries as much as 10 percent below amounts anticipated a month ago. While no serious water shortages are expected, some deficiencies will occur.

Carryover reservoir storage is good on both the North and South Platte rivers. On the South Platte it will tend to offset the below normal runoff.

ARKANSAS BASIN

While dry March weather dropped streamflow prospects for the main Arkansas river to a little below average, above normal snowfall on the Purgatoire and Cucharas rivers brought marked improvement in their water picture. Flow of these southern tributaries is now expected to be near average. However, principally because of low reservoir storage on the Arkansas, some shortages are anticipated.

The areas of above normal March snowfall extended southward into New Mexico, further improving the outlook for the Canadian river. Its flow should be more than 10 percent above average.

RIO GRANDE BASIN

Above normal snow during March resulted in an upward revision of stream forecasts for the Rio Grande and Pecos rivers. Water supplies should be good and better than in recent years. Inflow to El Vado reservoir should be near 175 percent of average, while the Rio Grande at Otowi Bridge is expected to be near 50 percent more than usual. The Pecos river should also produce an above average amount, near 120 percent. While total reservoir storage is slightly less than normal in the state's major reservoirs, Elephant Butte contains 366,000 acre-feet as compared to the 15 year (1953-67) average of 333,500 acre-feet.

COLORADO BASIN

The total effective snowpack on the upper Colorado River basin above Lake Powell declined slightly during March. Light snowfall on tributaries in Wyoming, northern Colorado and northern Utah dropped forecasts 5 to 15 percent below those of March 1st. However, heavy snowfall in southern Colorado and southern Utah, where forecasts raised about the same amount (5 to 15 percent) partly offset the decrease. Net change in expected inflow to Lake Powell was a drop of only 2 percent. Inflow is now forecast at 137 percent average.

Adequate to excellent water supplies are expected in all sections of the upper Colorado Basin. The Green river and its tributaries in Wyoming are expected to yield about average or slightly better amounts. The upper Colorado, Yampa and White rivers in Colorado are forecast at about 5 to 15 percent more than usual. In central and southern Colorado the Gunnison, Dolores and San Juan rivers as well as all Utah tributaries have potential flows ranging from 130 to over 200 percent of average.

In the lower Colorado Basin, Utah's Virgin river has a record snowpack and is forecast at 342 percent average. With the exception

SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1969 as of APRIL 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
UPPER MISSOURI	1968	1969	
Jefferson at Sappington, Montana	1012	1468	147
Madison near Grayling, Montana 1/	521	605	140
Gallatin near Gateway, Montana	641	575	124
Missouri near Landusky, Montana 2/		5400	120
Sun at Gibson Dam, Montana 3/	429	550	91
Marias near Shelby, Montana 4/	409	540	89
Milk near Eastern Crossing, Montana	278	265	101
Yellowstone at Yellowstone Lake Outlet, Wyo. (Apr-Oct.)		920	110
Yellowstone at Corwin Springs, Montana	2103	1980	105
Clark Fork at Chance, Montana	569	590	101
Shoshone, Inflow to Buffalo Bill Res., Wyo.		810	100
Wind at Dubois, Wyoming		94	95
Bull Lake near Lenore, Wyoming		178	100
Tensleep near Tensleep, Wyoming		63	85
Yellowstone at Miles City, Montana 5/		5900	101
Missouri near Williston, N. Dakota 6/		12010	109
PLATTE			
North Platte at Saratoga, Wyoming		660	119
Laramie near Jelm, Wyoming 7/		116	112
Clear at Golden, Colorado		95	80
St. Vrain at Lyons, Colorado		55	79
Cache LaPoudre near Fort Collins, Colorado 8/		178	83
ARKANSAS			
Arkansas at Salida, Colorado 9/		290	94
Purgatoire at Trinidad, Colorado		50	109
RIO GRANDE			
Rio Grande near Del Norte, Colorado 10/		530	121
Conejos near Mogote, Colorado 11/		240	132
El Vado Res. Inflow, New Mex.		330	176
Rio Grande at Otowi Bridge, New Mexico 12/		760	148
Pecos at Pecos, New Mexico *		50	122
UPPER COLORADO			
Granby Reservoir Inflow, Colorado 13/		230	105
Colorado at Dotsero, Colorado 14/		1550	112
Roaring Fork at Glenwood Springs, Colorado 15/		875	126
Gunnison at Grand Junction, Colorado 16/		1500	132
Dolores at Dolores, Colorado		350	152
Colorado near Cisco, Utah 16/ **	3653	3645	130
Flaming Gorge Res., Utah, Net Inflow 17/**	1061	1285	122
Yampa at Steamboat Springs, Colorado		285	110
White near Meeker, Colorado		325	111
Duchesne near Tabiona, Utah 18/ **	116	147	158
Whiterocks near Whiterocks, Utah **	75	84	165
Scofield Reservoir, Utah, Net Inflow 19/ **	45	70	219
Green at Green River, Utah 17/ **	1796	3361	131
Navajo Reservoir Inflow, New Mexico	591	1010	163
Animas at Durango, Colorado		550	134
San Juan near Bluff, Utah 20/**	923	1425	160
Colorado, Inflow to Lake Powell, Arizona 21/**	7247	8970	137
LOWER COLORADO			
Gila near Solomon, Arizona (April-May)	76	26	75
Salt at Intake, Arizona (April-May)	245	200	164
Verde above Horseshoe Dam, Arizona (April-May)	52	55	110

SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1969 as of APRIL 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
GREAT BASIN	1968	1969	
Bear at Harer, Idaho	231	365	162
Logan near Logan, Utah 22/ **	99	120	121
Ogden, Inflow to Pine View Res., Utah 23/ **	94	190	202
Weber near Oakley, Utah **	136	157	145
Utah Lake, Utah, Net Inflow **	267	350	179
Big Cottonwood near Salt Lake City, Utah **	38	46	135
Beaver near Beaver, Utah **	30	35	216
Sevier near Hatch, Utah	56	78	236
Humboldt at Palisades, Nevada **	81	310	201
Truckee at Farad, California 26/ **	155	550	213
East Carson near Gardnerville, Nevada **	120	365	208
West Walker near Coleville, California **	143	290	202
UPPER COLUMBIA			
Columbia at Revelstoke, British Columbia		17200	94
Kootenai at Wardner, British Columbia		4790	98
Kootenai at Leonia, Idaho	7901	9900	108
Flathead near Columbia Falls, Montana 27/	5485	6850	106
Flathead near Polson, Montana 27/	6438	8420	110
Clark Fork above Missoula, Montana	1434	2070	117
Bitterroot near Darby, Montana	548	615	110
Clark Fork at Plains, Montana 27/	10419	14060	112
Columbia at Birchbank, British Columbia 27/	46362	46500	100
Spokane at Post Falls, Idaho 28/	1775	4000	127
Columbia at Grand Coulee, Washington 27/	62649	74400	107
Okanogan near Tonasket, Washington		1740	100
Chelan at Chelan, Washington 29/	1225	1370	108
Wenatchee at Peshastin, Washington	1530	1920	106
SNAKE			
Snake above Palisades Res., Wyoming 30/		2700	106
Snake near Heise, Idaho 30/	3789	4100	110
Henry's Fork near Rexburg, Idaho 31/	1348	1430	116
Big Lost near Mackay, Idaho 32/	155	320	190
Big Wood, Inflow to Magic Res., Idaho 33/(Mar-July)	96	600	224
Bruneau near Hot Springs, Idaho	114	280	146
Owyhee Res., Net Inflow, Oregon	92	752	251
Boise near Boise, Idaho 34/	945	2300	148
Malheur near Drewsey, Oregon	14	115	160
Payette near Horseshoe Bend, Idaho 35/	1195	2600	141
Snake at Weiser, Idaho	4160	8700	138
Salmon at Whitebird, Idaho	5517	8700	127
Clearwater at Spalding, Idaho	6741	9800	114
LOWER COLUMBIA			
Grande Ronde at LaGrande, Oregon		187	107
Yakima at Cle Elum, Washington 36/		970	100
Deschutes at Benham Falls, Oregon 37/		530	89
Columbia at The Dalles, Oregon 27/	88503	116000	110
Hood near Hood River, Oregon 37/		444	132
Willamette at Salem, Oregon 37/		5199	100
Lewis at Ariel, Washington 38/		1530	113
Cowlitz at Castle Rock, Washington		2740	97

SELECTED STREAMFLOW FORECASTS April-September 1969 as of April 1, 1969

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
	1968	1969	
NORTH PACIFIC COASTAL			
Dungeness near Sequim, Washington		168	98
Rogue at Raygold, Oregon		1006	107
Klamath Lake, Net Inflow, Oregon		775	125
CALIFORNIA CENTRAL VALLEY 39/**			
Sacramento, Inflow to Shasta, California	1277	2400	137
Feather near Oroville, California	1141	3800	204
Yuba at Smartville, California	568	1860	171
American, Inflow to Folsom Res., Calif.	610	2400	181
Cosumnes at Michigan Bar, California	45	270	211
Mokelumne, Inflow to Pardee Res., Calif.	241	890	192
Stanislaus, Inflow to Melones Res., Calif.	389	1400	197
Tuolumne, Inflow to Don Pedro Res., Calif.	648	2450	208
Merced, Inflow to Exchequer Res., Calif.	274	1300	217
San Joaquin, Inflow to Millerton Lake, Calif.	552	3050	260
Kings, Inflow to Pine Flat Res., California	548	2950	258
Kaweah, Inflow to Terminus Res., California	131	800	307
Tule, Inflow to Success Res., California	21	220	393
Kern, Inflow to Isabella Res., California	232	1800	439

Forecasts in California provided by Department of Water Resources.
Average is for 1953-67 period except California. California is computed for 1916-65.
Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.
** April - June Period ** April - July Period*

of the Gila river where considerable pumping will be required to offset low streamflow prospects, the remainder of the basin will have good to excellent water this summer.

GREAT BASIN

Despite below normal March snowfall, mountain snowpacks in all parts of the Great Basin indicate that 1969 will stand out as one of the most abundant water years in history. Many snow courses in the Sierra Nevadas, the Mt. Charleston area northwest of Las Vegas, the mountains in the vicinity of Winnemucca, Nevada and near Cedar City in southern Utah have a deeper snowpack than in any year since snow surveys began, some records extending back 60 years. The Mt. Rose snow course near Reno, Nevada, the first snow course in the western United States, established in 1909 by Dr. James Church, now has 20 percent more snow water than at any previous time in its history.

While the snowpack is not this great record wise through the remainder of the Basin, it will rate among the highest two or three years of record in most areas. Lightest snowpack lies on the Logan river in northern Utah at 110 percent, while snow cover on the Bear river is 126 percent. Elsewhere the snow varies from a low of 132 percent on the Jordan river to about 200 to 220 percent on the Walker, Carson, Tahoe and Truckee watersheds in Nevada. Streams heading near Cedar Breaks National Monument in southern Utah have a snowpack near 3 times normal, while the pack in the Spring Mountains of southern Nevada is over 4.5 times normal. Snow cover ranges from about 140 to 160 percent average on the watersheds of Lake and Harney counties in Oregon, the Humboldt in Nevada and the Weber, Ogden and Utah Lake drainages of Utah.

Soil moisture is above average due to last summer's heavy rains. This will add to the volume and speed of the runoff when the snow melts.

All major streams in Nevada are predicted to flow in excess of twice their normal amounts while most Utah and Oregon streams should yield about 140 to 250 percent of average.

Reservoir storage is a little below average in Nevada and Oregon, but is near 30 percent above average in Utah. Many of the smaller reservoirs in Utah are filled to capacity and overflowing. Storage water has been released from several reservoirs in the Weber river

basin to make room for the anticipated heavy runoff.

In general, volumes of flow expected are below the amount experienced in 1952 and should cause no major widespread flooding problems. However, some high water problems are sure to develop in local situations in low lying or restricted areas. Some flooding has already developed in the Enterprise area of southern Utah when warm temperatures in late March began removing low elevation snows, flooding about a thousand acres of choice farm land.

COLUMBIA BASIN

Good to excellent water supplies are anticipated for all parts of the Columbia Basin and adjacent Pacific Northwest watersheds during 1969.

Very light snows fell throughout most of the Columbia Basin during March, further reducing the heavy snowpack (with respect to average) which had built up earlier in the winter. All sections of the United States portion of the Basin and adjacent watersheds have an average or better snowpack.

The British Columbia Water Resources Service reports the April 1st snowpack follows the same pattern as a month ago, that is, being heaviest in the south near the international boundary and decreasing to a little below average in central and northern regions. Streamflow forecasts follow this same pattern, with the upper Columbia and Kootenai rivers expected to yield slightly below average flows.

Mountain snowpacks in Montana range from about average on the Bitterroot and Flathead rivers to near 15 percent above on the upper Clark Fork. Snow on most Washington watersheds varies from about average to 20 percent above. It is somewhat greater in Oregon, with a low of 116 percent being reported for the Upper Deschutes river and Wallowa Mountains and increasing to a high of near twice normal on the Owyhee watershed. Lowest snow cover on the Snake river is above Jackson, Wyoming where it is essentially average. Heaviest snows along the Snake river in Idaho are on the Big and Little Wood and Bruneau rivers with about 175 to 200 percent being reported.

The areas of heavy snow cover in Idaho indicate that special high water problems will exist on the Big and Little Wood Rivers, Big and Little Lost Rivers, and Camas-Beaver Creeks above Mud Lake reservoir. These streams have such a heavy snowpack that damaging high water is forecast regardless of snowmelt conditions. Magnitude of the problem will depend on the weather during the main snowmelt period. Several intermediate elevation streams such as Squaw Creek near Emmett, Mann's Creek near Weiser, Camas Creek near Fairfield and Fish Creek near Carey have snowpacks which indicate potential high water problems. Ideal weather conditions could reduce or eliminate the hazard. Heavy spring rains could create very serious problems.

In Washington most streams are expected to yield average to about 15 percent above average flows. Oregon's Deschutes river should supply about 10 percent less than the usual amount, reflecting a carryover influence from last year's drought. The Willamette and Grand Ronde rivers should supply average or a little above the usual amount. Coastal streams, John Day, Powder and Klamath rivers are all forecast 110 to 130 percent average. The Hood, Burnt, Crooked and Malheur rivers have forecasts ranging from 130 to 160 percent, while the Owyhee forecast is 251 percent.

No problems from high water are foreseen on the major rivers where adequate reservoir control is available.

ALASKA

Snow cover is considerably below average over the major portion of Alaska. Particularly deficient areas include most of the Alaska Range of mountains, the Copper basin and the upper Yukon drainage.

Portions of the mountains of Southeast Alaska and the Kenai peninsula have near average snowpack. Storms in late March brought heavy snowfall to these regions. Other areas such as the lower Tanana drainage, the Chena watershed, and portions of the coastal drainage near Anchorage, also received substantial increases during the month. Snow cover, however, is still below average.

Soils are dry throughout the interior of the state and will absorb much of the snow melt. Streamflow during the spring and early summer is expected to be less than normal.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting in California, reports that despite below normal precipitation during March, California is experiencing one of the wettest water years of record. April 1 snow surveys show that this year's pack is approaching or surpassing previous records (some extending back for 60 years) in nearly all snowfed basins of the State. In the central and southern Sierra almost all pre-

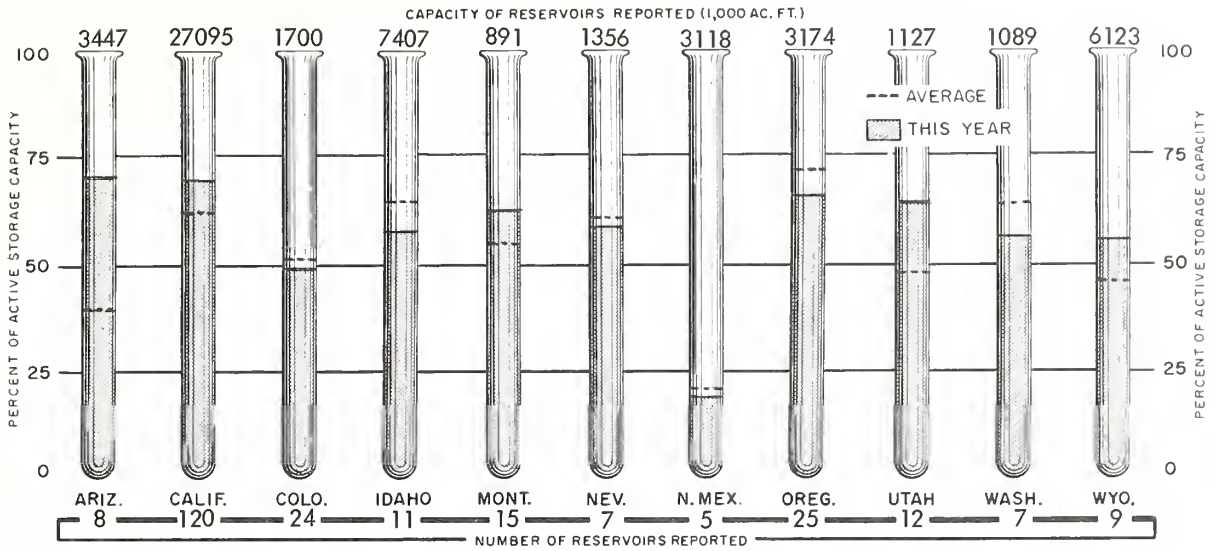
STORAGE IN LARGE RESERVOIRS APRIL 1, 1969

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER MISSOURI		
Belle Fourche	185	132
Boysen	550	281
Buffalo Bill	373	159
Canyon Ferry	2043	1469
Fort Peck	19410	16370
Garrison	24500	19170
Hebgen	377	295
Keyhole	340	125
Lake Francis Case	5816	3634
Lake Sharp	1900	1731
Oahe	23630	21059
Tiber	1347	502
Yellowtail	1356	695
PLATTE		
City of Denver	507	317
Colo-Big Thompson (3)	718	337
Glendo	784	432
Pathfinder	1016	390
Seminoe	1011	372
ARKANSAS		
Conchas	273	125
John Martin	354	19
RIO GRANDE		
Elephant Butte	2195	366
El Vado	195	4
UPPER COLORADO		
Blue Mesa	830	347
Flaming Gorge	3749	1623
Navajo	1696	663
Powell	25002	7392
LOWER COLORADO		
Havusu	619	554
Mead	27207	15386
Mohave	1810	1653
Salt River Res. (4)	1755	1585
San Carlos	1206	443
Verde River Res. (2)	318	253
GREAT BASIN		
Bear	1421	1044
Lahontan	287	177
Rye Patch	172	57
Sevier Bridge	236	165
Strawberry	265	157
Tahoe	732	539
Utah	884	863
Willard Bay	198	115

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER COLUMBIA		
Chelan	676	88
Coeur d'Alene	225	227
Duncan	1347	79
Flathead	1219	766
Hungry Horse	2982	2201
Kootenay	673	22
Lower Arrow	3083	388
Pend Oreille	1155	599
Roosevelt	5232	0
Upper Arrow	4061	319
LOWER COLUMBIA		
Cougar	155	52
Detroit	299	60
Hills Creek	200	62
Lookout Point	337	96
Yakima Res. (5)	1066	717
SNAKE		
American Falls	1700	1286
Anderson Ranch	423	181
Arrowrock	287	82
Brownlee	980	244
Cascade	653	209
Jackson	847	650
Lucky Peak	278	22
Owyhee	715	508
Palisades	1202	914
PACIFIC COASTAL		
Clair Engle	2500	1736
Clear Lake	440	235
Nacimiento	350	242
Ross	1052	480
Upper Klamath	584	501
CALIFORNIA CENTRAL VALLEY		
Almanor	1036	610
Berryessa	1602	1619
Folsom	1010	454
Isabella	570	175
McClure	1026	644
Millerton	521	146
Oroville	3484	2935
Pine Flat	1013	665
Shasta	4500	3667

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.

RESERVOIR STORAGE as of APRIL 1, 1969



vious records of the snowpack's water content have been broken. Extended sustained flows are forecasted for all the State's snowfed streams this spring and summer.

Because of the flood potential from the record snowpack in the San Joaquin Valley, all water agencies in the area are coordinating their activities to convey the large volumes to the Delta with the least damage possible. In the Tulare Lake Basin local, State, and Federal agencies are cooperating closely to hold the lowland flooding to a minimum by diversion, increased ground water recharge, maximum water use, and through pumping into the California Aqueduct. Still, latest estimates show that with a reasonably favorable time distribution of snowmelt from 500,000 to 1,000,000 acre-feet more inflow, primarily from the Kern River, will have to be accommodated in Tulare and Buena Vista Lakes.

Precipitation during March for California was almost completely restricted to the first three weeks and then was limited to fast moving cold-type storms. Their contribution amounted to only 50 percent of the normal expectancy for the month, a respite from the wet conditions the State experienced in January and February. The hard-hit central and southern Sierra again received the heavier amount, with precipitation over these areas ranging from 60 to 80 percent of normal for March. Precipitation since October 1 is now 165 percent of normal for the State as a whole with all major water producing areas experiencing well above normal amounts. In the Central Valley, individual Sierra drainages range from 130 percent of normal precipitation in the Upper Sacramento River Basin to 260 percent of normal in the Kaweah River Basin.

April 1 snow surveys show that almost all previous records have been broken in the higher elevations of the Sierra. Statewide, the snowpack water content was 210 percent of the April 1 average. Snow courses above the 7,000 foot level in the central and southern Sierra average 60 to 80 inches of water.

Runoff during March was near normal or above throughout the State except in the Lahontan area where it was 95 percent of normal. Continuing the pattern of January and February, the largest runoff volumes, with respect to normal, occurred in the South Coastal area where key streams averaged 295 percent of normal for the month. In the Sacramento and San Joaquin Valley streamflow remained high averaging 115 percent and 175 percent of normal, respectively. Runoff from all California watersheds during March was about 120 percent of normal, reducing the season-to-date total to about 180 percent of normal.

April 1 forecasts of April-July runoff from Sierra watersheds were lowered slightly for streams tributary to the Sacramento Valley, but generally remained the same as those reported one month ago for tributaries to the San Joaquin Valley. Based upon the assumption that normal precipitation will occur during the remainder of the season, streams tributary to the Sacramento and San Joaquin Valleys are expected to be 175 percent and 230 percent of April-July average, respectively.

As of March 1, 120 of California's major reservoirs were storing 18,410,000 acre-feet. This is 68 percent of their aggregate capacity, 110 percent of their 10-year average, and reflects a net storage gain during the past year of 400,000 acre-feet. In anticipation of the near record snowmelt volumes which will occur in the next few months, reservoirs in the Central Valley are maintaining flood control reservations except in the Tulare Lake Basin. Here, controlled releases are being made to regain flood control space necessary for optimum operation during one of the most critical snowmelt periods of modern times.

EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River. 10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs.

11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffat Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Blue Mesa reservoir. 17/ Change in storage in Flaming Gorge, Fontenelle and Big Sandy reservoirs. 18/ Plus diversion through Duchesne Tunnel. 19/ Change in storage in Scofield Reservoir. 20/ Change in storage in Navaho Reservoir.

2 21/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell and Big Sandy reservoirs. 22/ Plus Utah Power and Light Company tailrace and and Logan, Hyde Park, and Smithfield canals. 23/ (Inflow record computed by U. S. Bureau of Reclamation.) 24/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 25/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct.

26/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee) 27/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 28/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 29/ Change in storage in Lake Chelan. 30/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/

31/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg. 32/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 33/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 34/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 35/ Change in storage in Cascade and Deadwood reservoirs. 36/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 37/ (Corrected to natural flow). 38/ Change in storage in Merwin, Yale, and Swift reservoirs. 39/ (Corrected for upstream impairments).

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